4.12 Human Health and Safety

SIGNIFICANCE CRITERIA

Human health and safety related impacts that could be considered significant include those that would:

- Create a potential public health hazard
- Involve the use, production, or disposal of materials which pose a hazard to people
- Interfere with emergency response or evaluation plans

METHODOLOGY

Health and safety analysis for the project was conducted by identifying the surrounding receptors that may be subject to health and safety impacts and the hazardous materials that would be associated with the project. The manner in which the identified materials would be handled is analyzed for sufficient precautionary measures. Physical hazards that may result from project implementation and associated adverse impacts are also identified. The potential degree of impact from identified hazards is analyzed based on physical conditions, proposed project measures, and regulatory standards. Additional safety and preventative measures are recommended as needed.

IMPACT OVERVIEW

The project would have the potential for spills and hazards associated with oils and lubricants used during project construction. The project would also result in potential for fire hazards. Implementation of proposed measures would reduce hazard potential to less than significant levels. The project would also have the potential for pipeline spills during operation. Incorporation of recommended mitigation measures would decrease potential for and magnitude of leakage hazards to less than significant levels.

SENSITIVE RECEPTORS

Receptors of human health and safety impacts that may result from the project include occupants of the surrounding I'SOT mobile and group homes, rural medical-dental-behavioral health clinic, dining hall, and school. Receptors also include agriculture and custom haying workers along the discharge pipeline route and motorists along State Route 299. The 6 to 10 workers required during project construction may also be exposed to potential project-related hazards.

EFFECTS OF ALTERNATIVE A (PROPOSED PROJECT)

Hazardous Materials

Materials of concern for accidental spillage and leakage that would be used during project construction or operation include:

- Petroleum products
- Heavy metals collected in filters
- Geothermal fluid

Lubricating or Fuel Oils and Petroleum Products. Some hazardous materials from project-related activities (i.e., fuels, oils) would be present on-site during construction activities. The likelihood of substantial spills and discharges in this area would be low due to the limited amount of chemicals that would be used or transported. Hazardous chemicals to be transported include fuels, oils, and lubricants used during construction. The potential discharge of oils or petroleum products could occur from equipment leakage and would involve a very small volume.

Possible locations for accidental spills during construction are throughout the project area and along the route from the project site to the equipment maintenance site. The construction equipment would be maintained at the I'SOT Auto Shop, located a 0.5-miles away on industrially zoned I'SOT property. Implementation of Mitigation Measure 4.12-2 would reduce the potential for equipment leakage to a less than significant level.

Use of the propane boiler for back-up heating may result in propane leakage. The propane boiler would require a 1,500 to 2,000 gallon propane storage tank to provide one week's backup operation at peak rated rates. The propane boiler would be located in the mechanical and control building, thus spills from the boiler would be contained within the building. Propane leakage may occur outside the building during transport. Implementation of Mitigation Measure 4.12-2 would reduce the potential for propane leakage to less than significant.

Hazards related to spills of lubricating or fuel oils and petroleum products include:

- Possible fire hazard
- River water, soil, and vegetation contamination

Fluid spills are not expected to be in large amounts. The risk of fire would not be significant because I'SOT would maintain fire fighting equipment and trained fire fighters in the vicinity. Effects to soils, vegetation, and surface water would be limited because of the limited amount of the materials to be used. I'SOT would clean up spills according to hazardous materials requirements of the County and state.

Mercury. Possible spills may also occur from transport of discarded mercury (Hg) and contaminated carbon from the filtration system (discussed under Waste Disposal below) when the system reaches saturation and is cleaned. Discarded filter material would be treated as a hazardous material by the licensed vendor and disposed of in a Class 1 landfill outside Modoc County.

The geothermal resource contains a maximum of 231 nanograms per liter (ng/L) of mercury (Basic Laboratory 2002). The mercury would be removed from the geothermal fluids using Granular Activated Carbon (GAC). The GAC filters are designed to filter geothermal fluid (water) before discharge into the Pit River. Removal efficiency decreases with increased flow rates. Any remaining mercury that would be discharged would be diluted in the Pit River. Section 4.3, Hydrology and Geothermal Resources provides further information on possible mercury contamination of the Pit River.

Geothermal fluid from the geothermal well (ISO-1) has an average mercury level of 187 ng/L and a maximum of 231 ng/L (Basic Laboratory 2002). At 99% removal efficiency, the GAC filtration system is expected to remove 185 nanograms of mercury for every liter of geothermal fluid at average flow, and 229 nanograms of mercury for every liter of geothermal fluid at peak flow. It is estimated that flow into the filter would be at about 37 gpm 17% of the year, at 10-30 gpm 45% of the year, and at 10 gpm 38% of the year. Fluid flow is not expected to reach 60 gpm because the well has not been able to flow at 60 gpm.

Peak use discharge to the filter skid would be 37 gal/min (gpm) or 168 L/min. At this flow rate, assuming initial mercury concentration at 231 ng/L and a projected 98% removal factor, the filters would remove 226 nanograms of mercury for every liter of geothermal fluid. Projected mercury collection at the filters, assuming peak demand throughout the year and maximum mercury concentrations in the geothermal fluid, would be approximately 20 grams per year. This projected maximum accumulation is based on Basic Laboratory tests that have yielded a possible efficiency factor for peak flow. Actual accumulated mercury per year may be less than 20 grams. Potential for mercury spills would be less than significant because of the safety procedures I'SOT would follow for handling mercury. Any spills of mercury would occur in the building and would be cleaned up using standard operating procedures appropriate for mercury.

Waste Disposal

Hazardous wastes would not be produced during construction. During project operation and in the event that the activated carbon filters reach saturation, the GAC filters would be cleaned by a licensed vendor and the contaminated carbon would be replaced with fresh activated carbon. The lifespan of the filters is not known; the filters would be analyzed monthly. Upon filter saturation, a licensed vendor would process the contaminated carbon for mercury recovery. Discarded filter material would be treated as a hazardous material by the licensed vendor and disposed of in a Class 1 landfill outside Modoc County.

The potential for spills from the GAC filters during removal and transport of mercury-contaminated carbon would be less than significant. The filters have about 2,000 lbs of granular activated carbon and would be cleaned upon saturation by a licensed vendor (the lifespan of these filters is unknown). Analysis of the filters in the system would be conducted on a monthly basis. Likelihood of spills from maintenance of the filtration system would be minimal because a licensed vendor (US Filter) would perform maintenance according to standard procedures for handling mercury materials.

Pipeline Spills

If fluids of high temperatures were released outside of the system, there would be minimal impacts. Likelihood of pipeline leaks would also be minimal at the discharge pipeline as it would not be pressurized; flow along the discharge pipeline would depend on gravity. The geothermal fluid would be at approximately 200˚F at the well head. Most of the heat in the fluid would be dissipated during space heating. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). Fluids of this temperature would not have an adverse effect on vegetation. Due to the porous nature of the soil, fluids would quickly percolate into the soil minimizing the effect. If a leak in the pipeline occurs, the system would be shut down and replaced with the back-up propane boiler until repaired.

Potential spills of filtered geothermal fluid may occur along the unpressurized portion of the discharge pipeline. Based on conversation with the RWQCB (Rohrbach 2002b) it was determined that given the specifications of the discharge pipeline, the pipeline leak monitoring method initially outlined in the WDR (Appendix D) required more detail. The 3-foot deep pipeline would be laid on a gravel bed, directing leaking fluids downward. Surface pooling of leakage would be unlikely and measurements of flow would be more effective at leak detection (Rohrbach 2002b). Mitigation Measure 4.3-2 (see 4.3 Hydrology and Geothermal Resources) would enable monitoring for pipeline leaks, and would therefore minimize the potential duration and magnitude of impacts due to leakage. Pipeline leaks would not directly affect human receptors or wildlife because the pipelines would be buried.

The pressurized portion of the pipe is not expected to be an area of concern regarding pipeline leaks as it would run a very short length (less than 8 feet) from the well to the mechanical and control building, within the I'SOT community. Most of this pipe run would be inside of the mechanical and control building and there would be enough flex joints along the segment to take up any thermal expansion or contraction. Thermal expansion and contraction would be minimal and not an issue of concern; thermal expansion and contraction would be an issue of concern if the pipe run would be several hundred feet. The thermal expansion and contraction would also be minimal as the temperature of the fluid would be relatively low (180^0F to 200^0F).

The following issues are potential areas of concern regarding pipeline leaks:

- **Groundwater mercury contamination.** The pressurized portion of the pipeline is not a segment of concern regarding leakage because it runs a very short length and because there would be enough flex joints to accommodate the expected minimal thermal contraction and expansion. The pipeline segment of concern for leakage would be the unpressurized portion of the discharge pipeline after the GAC filters. The unpressurized portion of the pipeline would run 5,400 feet along predominantly grazing land. Thermal expansion and contraction would not be an issue of concern along the discharge pipeline because water temperature would be about 80˚F. Mercury content in the geothermal fluid would decrease significantly after filtration. The Human Health Limit in the California Toxics Rule (CTR) for consumption of water and organisms is 50ng/L for mercury. After filtration, mercury levels in the effluent would range from 2 to 19 ng/L, below the 50 ng/L Human Health Limit. The 50ng/L limit is not protective of aquatic wildlife; vegetation and wildlife would not be affected by groundwater contamination. Section 4.3 Hydrology and Geothermal Resources provides further information on impacts of pipeline leakage on groundwater.
- **Groundwater arsenic and boron contamination**. Arsenic levels in the geothermal fluid range from 99 – 110 µg/L. The Safe Water Act Maximum Contaminant Level (MCL) for arsenic is 10 µg/L. The highest concentration of boron in the geothermal fluid is 4,090 µg/L. Boron is not a priority pollutant; however, the receiving water objective established in Order No. R5-2002-0079 is 600 µg/L. Concentrations of arsenic and boron would not increase over time. Implementation of Mitigation Measure 4.3-1 (see 4.3 Hydrology and Geothermal Resources) would reduce potential for pipeline leaks to less than significant levels.
- **Vegetation impacts.** The pipeline would be buried and laid in gravel so spilled material would percolate downward. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). Fluids of this temperature would not have an adverse effect on vegetation. Vegetation in the area is too shallow-rooted to uptake any metals associated with potential spillage (see 4.4 Biology for further discussion), which would occur below 3 feet from the surface.
- **Wildlife impacts.** The pipeline would be buried and laid in gravel so spilled material would percolate downward. Due to the porous nature of the soil, fluids would quickly percolate into the soil. The geothermal fluid would have a relatively low temperature in the discharge pipeline (80˚F). No direct hazards on wildlife would result from leaks along the unpressurized discharge pipeline because the pipeline would be buried and leaks would not travel up to the surface. There would be no adverse impacts to grazing animals because surface vegetation would not be affected by leaks in the buried pipeline and the local vegetation is too shallow-rooted to uptake metals associated with pipeline leaks.

- **Contamination of yards along pipeline.** The pressurized portion of the pipeline has enough flex joints along the segment to take up any thermal expansion or contraction, which may lead to leakage. The pressurized pipeline is also less than 8 feet and would mostly be contained within the mechanical building. There is little likelihood of hazards from the pressurized pipeline. The unpressurized portion of the discharge pipeline would be buried and leaks form that segment would not directly affect humans. Due to the porous nature of the soil, fluids would quickly percolate into the soil minimizing the effect.

Implementation of Mitigation Measures 4.3-1 and 4.3-2 (see 4.3 Hydrology and Geothermal Resources) would reduce potential for pipeline leaks to less than significant levels. Implementation of Mitigation Measure 4.12-6 would minimize impacts of pipeline leaks to less than significant levels.

Fire

Potential sources of fire from the proposed project include:

- Sparks from welding or related operations (cutting, grinding, etc.)
- Broken glass, if not properly disposed
- Cigarettes, if carelessly discarded
- Hydrogen peroxide spills (if it is used)

Potentially flammable/combustible chemicals that would be used in the proposed project include oil and fuel. Common natural sources of fire include lightning strikes. Environmental conditions such as weather and the "light fuel" grasslands in the project area may further contribute to fire potential from the project. Mitigation 4.12-3 to 4.12-5 would reduce potential for fire hazards to less than significant.

Well Blowout

Well blowouts are accidental, uncontrolled releases of geothermal fluids such as steam, gases, or hot water from a geothermal well. Blowouts may occur during well drilling and during utilization. The potential concerns regarding accidental releases of geothermal fluids include effects to surface water and shallow groundwater resources, hazards to workers' health and safety, and release of hydrogen sulfide (during drilling). A well blowout usually occurs from over pressurization of either the well casing, control valve or formation and almost all well blowouts occur in high-pressure geothermal areas. The potential for a blowout to occur at the proposed project is very low because the project is using an existing well and the geothermal resource at the project is a lower pressure resource. The existing well requires a submersible pump to produce the resource. The existing well reaches a depth of 2,105 feet and taps into a low-temperature resource (180°F to 200°F) suitable for direct use.

Blowouts usually occur in high-temperature, high-pressure wells. Of the hundreds of geothermal wells in the United States, the Geothermal Resources Council has records for only seven blowouts (BLM et al. 1998), all of which were controlled within a few days time. In the unlikely event of a blowout, the geothermal fluids would flow from the well into the adjacent pasture. The primary impact of this discharge would be the temporary effect of high temperature water on the existing grass and pasture vegetation. The chemistry of the geothermal fluid is slightly higher in total dissolved solids than the cold water wells in the area used for pasture watering which could increase the salinity of the soils in the spill area.

Emergency Response

The proposed project construction and operation would not cause a significant interference with emergency access in the project region. The pipeline would cross Highway 299 but is not expected to result in a significant degradation of traffic movement (see Section 4.11 Transportation and Traffic). The project would not result in a significant effect due to interference with emergency access.

MITIGATION MEASURES

Mitigation Measure 4.12-1

Prior to project commencement, I'SOT will submit a site construction and safety plan to the Director of the Modoc County Planning Department for review and approval. The purpose of the plan shall be to ensure public safety during all phases of project construction through:

a. The installation of safety signage, placed as appropriate within the construction corridor, that warns of risks associated with on-site construction activities and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of active construction equipment
b. The installation of temporary safety fencing to restrict or prevent public access to active on-site construction sites or equipment

Mitigation Measure 4.12-2

Prior to project commencement I'SOT will submit to the Director of the Modoc County Planning Department for review and approval a safety plan. The purpose of the plan is to minimize the exposure of the public to potentially hazardous materials during all phases of the project through:

a. Appropriate methods (e.g., Best Management Practices) and approved containment and spill-control practices (e.g., spill control plan) for transport and storage of chemicals and materials on-site
b. Safety signage, placed as appropriate along the construction corridor during construction or repairs, that warns of risks associated with on-site construction materials and outlines measures to be taken to ensure safe use of facilities near construction areas and avoidance of construction materials
c. Temporary safety fencing during construction or repairs to restrict or prevent public access to active on-site construction materials or chemicals

Mitigation Measure 4.12-3

I'SOT will ensure that all construction equipment will be equipped with fire potential reduction equipment, such as but not limited to spark arresters, mufflers, etc.

Mitigation Measure 4.12-4

I'SOT will ensure that fire preventative measures are taken during potentially hazardous operations, such as welding.

Mitigation Measure 4.12-5

I'SOT will ensure that fire fighting equipment is supplied to the project site. Fire detectors, fire extinguishers, and hand-held fire fighting equipment would be available and maintained at the mechanical control building as well as the food service/laundry building for the duration of the project.

EFFECTS OF ALTERNATIVE B (NO ACTION)

If the project were not constructed due to lack of DOE funding, there would be no adverse effects on human health and safety from Alternative B, the "No Action" alternative; however, the project could proceed without DOE funding contingent upon alternative funding, with effects from Alternative A potentially worse without DOE participation because no mitigation would be required (except NPDES required items). The following measures would not be implemented without DOE involvement: 4.12-1, 4.12-2, 4.12-3, 4.12-4 and 4.12-5. Without funding by DOE, I'SOT would not be reimbursed for costs resulting from permitting efforts, engineering consultation, and system installation costs. No data gathering system would be installed for DOE research and development (R&D) purposes.